REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicants respectfully submit that the present invention is new, non-obvious and useful. Favorable reconsideration and allowance of the claims is respectfully requested.

Status of Claims

Claims 1-19 remain pending in the application. Claims 1 - 7, 9 - 16 and 18 - 19 have been amended. New claims 20 - 23 have been added. Applicant respectfully asserts that no new matter has been added.

Remarks to the Specification

The specification has been amended to correct various typographical errors and to remove obvious inconsistencies between the specification and the drawings. These changes are directed strictly to matters of form and, therefore, do not affect the scope of the claims or create any prosecution history estoppel. It is respectfully submitted that no new matter has been added to the specification.

CLAIM REJECTIONS

35 U.S.C. § 112 Rejections

Claims 9 and 18 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In particular, the Examiner contended that the specification fails to teach how the wedge with polarization reflective planes could be a "controllable polarized reflecting device". Claims 9 and 18 have been amended such that the term "controllable" is not included in these claims.

Claims 1 - 19 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, the Examiner contended that the phrase "complementary fractions" recited in claims 1, 10 and 19 is indefinite since it is not clear what specific property is referred to as being "complementary" among each of the image fractions. Claims 1, 10 and 19 have been amended such that the term "complementary" is not included in these claims.

As per claims 3 and 12, the Examiner contends that the elements recited are not equivalent to each other, which therefore makes the scope of the claims unclear. Claims 3 and 12 have been amended such that only the element "binary optics" is now recited in these claims.

As per claim 19, the Examiner contends that the phrase "significantly greater" is indefinite since it is not clear what is the exact degree considered here to be "significant". Claim 19 has been amended such that the term "significantly greater" is not included in this claim.

Applicants respectfully submit that, in view of the preceding arguments and amendments, claims 1 - 19 now meet the requirements of 35 U.S.C. § 112, first and second paragraphs. Therefore, applicants respectfully request that the rejections be withdrawn.

35 U.S.C. § 103 Rejections

Claims 1-6, 8, 10 - 15, 17 and 19 are rejected under 35 U.S.C. § 103(a), as being unpatentable over Chern (US Patent 4,968,117) in view of Diepeveen et al. (US 4,682,029). Applicants respectfully traverse this rejection in view of the remarks that follow.

Claims 1, 10 have been amended to recite "a redirecting unit coupled to said image source to direct said fractions to respective non identical spatial regions of a (said) reflecting unit such that said fractions are viewed by a person as a spatially integrated image." Similarly, claim 19 has been amended to recite "directing said image fractions to respective non-identical spatial regions of a reflecting unit, such that said image fractions are viewed by a person as spatially integrated image". It is respectfully submitted that these amendments have been made to more clearly define the claimed subject matter and they do not narrow the scope of the claims.

It is well established that obviousness requires a teaching or a suggestion by the relied upon prior art of all the elements of a claim (M.P.E.P. §2142).

Applicants respectfully assert that neither Chern nor Diepeveen et al., alone or in combination, teach or suggest each and every element of claims 1, 10 and 19. In particular, neither Chern nor Diepeveen teach or suggest "a redirecting unit coupled to said image source to direct said fractions to respective non identical spatial regions of a (said) reflecting unit such that said fractions are viewed by a person as a spatially integrated image", as recited in amended claims 1 and 10. Similarly, neither Chern nor Diepeveen teach or suggest "directing said image fractions to respective non-identical spatial regions of a reflecting unit, such that said image fractions are viewed by a person as spatially integrated image", as recited in amended claim 19.

In contrast, Chern is directed to a binocular visor system in which light emanating from an object source is split into two beams by a beam splitter, and each beam is then redirected into a respective eye (see col. 23 of Chern). Diepeveen et al. is directed to a stereoscopic infrared imager that includes a scanning mirror, which scans two infrared images across a single infrared detector array (see abstract).

Therefore, the proposed combination of binocular system of Chern and the stereoscopic imager of Diepeveen fails to teach or suggest all the elements of claims 1, 10 and 19. Furthermore, it is respectfully submitted that the proposed combination teaches away from redirecting fractions of an image optically transferred by relay optics having a field of view associated with the image fractions such that a re-integrated image may be viewed from spatially non-identical regions of a reflecting unit, as required by amended claims 1, 10 and 19, because neither of the cited references is concerned with reconstructing an image from non identical spatial image fractions.

In view of the above, applicants respectfully submit that amended claims 1, 10 and 19 are patentable over the combination of Chern and Diepeveen, and respectfully request that the rejection of these claims be withdrawn.

Claims 2-6, 8, 11 - 15 and 17 depend, directly or indirectly, from one of the independent claims 1 and 10 and therefore include all the limitations of its parent claim. Therefore, applicants respectfully request that the rejection of claims 1-6, 8, 10 - 15, 17 and 19 be withdrawn based on the patentability of amended claims 1 and 10.

Claims 7, 9, 16 and 18 are rejected under 35 U.S.C. § 103(a), as being unpatentable over Chern (US Patent 4,968,117) and Diepeveen et al. (US 4,682,029), and further in view of Chauvin (US 5,198,928). Applicants respectfully traverse these rejections in view of the remarks that follow.

Claims 7, 9, and 31 - 33 are dependent from claims 1 and 10, respectively, and include all the limitations of the independent claims. Applicants therefore respectfully submit that the rejections of these claims should be withdrawn by virtue of the patentability of the independent claims upon which they depend.

In view of the foregoing amendments and remarks, the pending claims are deemed to be allowable. Favorable reconsideration and allowance of the application are thus respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 05-0649.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification

The paragraph beginning at page 3, line 23, has been amended as follows:

Fig. 2A illustrates a preferred embodiment of the current invention according to which an image is produced by image source 30, received by relay optics 10, deviated/reflected at a high speed in more than one direction by image redirector 40, and superimposed in visor 15 in more than one location. The images, from [the] more than one location, reflect off the visor 15 and are received by the eye of the user 16. Since the switch between the image fractions being projected onto the different locations on the visor happens at a high speed, the eye does not detect said switching and the over-all image received by the viewer's eyes is a seamless superimposition of the different fractions of the image. [Accordingly, and the] The total FOV (TFOV) is thus [significantly] increased roughly [by substantially] according to the number of the image fractions. The seamless integration of the images, from plurality of fractions of an image to a whole image, becomes possible due to the high rate, time-integration performed by the eye of the viewer and viewed as one wide image. Seamless integration of the different fractions of the full image become possible also by using known techniques such as creating the fractions so as to slightly overlap each other, and by controlling the intensity of the image of each fraction in the overlap zone to gradually [lower] decrease as the distance to the edge of the image fraction becomes smaller.

The paragraph beginning at page 4, line 24, has been amended as follows:

The image redirector 40 may be one of:

- tilting mirror,[or] or

- electro-optic lens - liquid crystal based diffractive lens, which receives electrical impulses for different reflective or deviated angles (such as Electrically Switchable Holographic Optical Element (ESHOE) by DigiLens Technologies Inc. of Sunnyvale, CA, USA) ,or Hologram.

Digital Micromirror Device (DMD) or Digital Light Processing (DLP) [maid] made by Texas Instruments or Light Valve Mirror (LVM) [maid] made by IBM montation or similar with two stages (black & white pictures),

or any other type of device that can switch \ divert the light from one direction to more than one direction.

The paragraph beginning at page 5, line 19, has been amended as follows:

Reference is now made to Fig. 2B, a time sequential of the operation of the apparatus detailed in Fig. 2A, when operating as time domain device (i.e. an operation in which the different fractions of the image employ different time slots for projection). Note that the top line depicts the selective image fractions produced by image source unit 30, first image 101 and second image 201, and the bottom line depicts the reflective position of the image redirector 40, image 101 to the left and image 201 to the right. Thus, it is clear that the image source 30 has to be synchronized with the image redirector when operating as a time-domain device. It [is also] should be noted that the examples depicted in Figs. 2A and 2B employ two fractions of an image, but the invention is not limited by this example, and the total image may be combined of more than two fractions.

The paragraph beginning at page 6, line 5, has been amended as follows:

Fig. 3 is a schematic illustration of an alternative embodiment of the present invention. The image produced in image source 30 is divided into two complementary frames, 72 with polarization P, and 74 with polarization S. Frame 72 represents the fraction of the source image that corresponds to the first section on visor 15. Frame 74 represents the fraction of the source image that corresponds to the second section on visor 15. Both frames are projected through an optical combiner 70, and their respective out going optical lines 82 and 84 are projected simultaneously along a common optical axis from the optical combiner 70 through the relay optics 10 and optionally via an Electro Optical (EO) lens 76. The optical combiner 70 may be any of the existing combiner / splitter such as those manufactured and distributed by KARL Lambrecht Co. Chicago, IL, USA. The need for EO lens is dependent on the embodiment of the image redirector 40, as will be explained below. When the EO lens 76 is in use, its activity is synchronized with the image source so as to allow the free passage of only one of the frames, 72 [and] or 74 [at once]. The [outlet] image received from relay

optics 10, whether projected via EO lens 76 or not, is then projected through image redirector 40.

The paragraph beginning at page 7, line 10, has been amended as follows:

Fig. 4B illustrates another embodiment of the current invention, in which image redirector 40 of Fig. 2A (not shown) is embodied by an optical device 92 (such as, for example, a wedge with two polarization-dependent reflective planes). In this embodiment, the reflection angle depends only on the polarization of the image, hence two images 72 and 74 are projected continuously onto device 92, and are reflected in different directions (82' and 84') respectively to visor 15, so as to compose a seamless, wide FOV angle, full image of the two polarized fractions of the source image. The FOV angle of the composed image equals substantially to twice the original FOV angel of the relay optics. In this embodiment the EO lens is not needed, since no switching in time is employed. In this embodiment no time-alternation is employed.

The paragraph beginning at page 8, line 3, has been amended as follows:

It is noted that the embodiment depicted in [the] Fig. 4A provides time integration of the produced image. Conversely, the embodiment depicted in Fig. 4B [allow] allows for integration in space.

The paragraph beginning at page 8, line 9, has been amended as follows:

In yet another embodiment, the distinction of one image fraction from another may be done using different [wavelength] wavelengths for each image fraction. In this embodiment image source 30 and image redirector 40 of Fig. 2A may employ cut-off filters to eliminate undesired images in time-domain using wavelength based filters, providing for ability to produce color images.

The paragraph beginning at page 9, line 2, has been amended as follows:

In yet another embodiment, the outer visor surface may get an "opposite" optical power to generate a normal (optical power "0") see-through capability. This can be done by implementing diffractive optics on the [visor] visor's outer side.

The paragraph beginning at page 9, line 6, has been amended as follows:

Using the same optical relay 10 to achieve a non-distorted wide-FOV imagery, the field correction can be done by reverse-image correction manipulation on the image source such that the projected image to the eye will be non-distorted[. Or] , or the correction can be done on the reflected element 15 (visor/combiner) by using a powered reflected optical element such as diffractive, hologram, binary optics.

In the Claims

Claims 1 - 7, 9 - 16 and 18 - 19 have been amended as follows:

1. (Once Amended) Apparatus for [increasing the] producing a wide field of view [of an image], the apparatus comprising:

an image source [for producing said] to produce non identical spatial image fractions;

relay optics having a [first] field of view associated with [, for optically transferring] said image fractions; and

a redirecting unit coupled to said image source to direct [for selectively directing complementary] said fractions [of said image] to respective non identical spatial regions of a reflecting unit [at at least two angles, said redirecting unit switching between said angles at a speed] such that [the received image is invisibly and seamlessly] said fractions are viewed by a person as a spatially integrated image [and the resultant field of view at said reflecting unit is wider than said first field of view].

2. (Once Amended) The apparatus of claim 1, wherein said reflecting unit comprises [having] diffractive optics formed therein.

3. (Once Amended) The apparatus of claim 2 wherein said diffractive optics [is one of] comprises binary optics[, holograms and optic-powered implemented optics].

4. (Once Amended) The apparatus of claim [2] 1 wherein said reflecting unit [having] comprises diffractive optics on its inner and outer faces so to create a total zero optical power for the outer scene.

5. (Once Amended) The apparatus of claim 1, wherein the number of said fractions [of an image] is at least two.

6. (Once Amended) The apparatus of claim 1, wherein said fractions [of an image] are of different wavelength.

7. (Once Amended) The apparatus of claim 1, wherein said fractions [of an image] are of different polarization.

9. (Once Amended) The apparatus of claim 1, wherein said redirecting unit comprises a [controllable] polarized reflecting device.

10. (Once Amended) A helmet [for providing an image to a user, the helmet] comprising:

a reflecting unit with operative connection to said helmet;

an image source [for producing said] to produce non identical spatial image fractions;

relay optics having a [first] field of view associated with[, for optically transferring] said image fractions; and

a redirecting unit coupled to said image source to direct [for selectively directing complementary] said fractions [of said image] to respective non

identical spatial regions of said reflecting unit [at at least two angles, said redirecting unit switching between said angles at a speed] such that [the received image is invisibly and seamlessly] said fractions are viewed by a person as a spatially integrated image [and the resultant field of view at said reflecting unit is wider than said first field of view].

11. (Once Amended) The helmet of claim 10, wherein said reflecting unit [having] comprises diffractive optics formed therein.

12. (Once Amended) The helmet of claim 11 wherein said diffractive optics [is one of] comprises binary optics[, holograms and optic-powered implemented optics].

13. (Once Amended) The helmet of claim 10 wherein said reflecting unit [having] comprises diffractive optics on its inner and outer faces so to create a total zero optical power for the outer scene.

14. (Once Amended) The helmet of claim 10, wherein the number of said fractions [of an image] is at least two.

15. (Once Amended) The helmet of claim 10, wherein said fractions [of an image] are of different wavelength.

16. (Once Amended) The helmet of claim 10, wherein said fractions [of an image] are of different polarization.

18. (Once Amended) The helmet of claim 10, wherein said redirecting unit comprises a [controllable] polarized reflecting device.

19. (Once Amended) A method for producing a wide FOV [in system having image source, relay optics and redirecting unit and reflecting unit], said method comprising [the steps of]:

[splitting the image from said an image source into plurality of complementary] producing non-identical spatial image fractions;

optically transferring said image fractions to a redirecting unit through relay optics[, said relay optic] having a [first] FOV associated with said image fractions; and

[projecting] directing said image fractions [from said relay optics onto said redirecting unit, said redirecting unit selectively switching said image fractions in different angles onto said] to respective non-identical spatial regions of a reflecting unit, such that [the resultant image received from said reflecting unit is a seamless combination of] said image fractions are viewed by a person as spatially integrated image [having a second FOV significantly greater than said first FOV].

New claims 20 - 23 have been added as follows:

20. (New) The apparatus of claim 2 wherein said diffractive optics comprises holograms.

21. (New) The apparatus of claim 2 wherein said diffractive optics comprises optic-powered implemented optics.

22. (New) The helmet of claim 11 wherein said diffractive optics comprises holograms.

23. (New) The helmet of claim 11 wherein said diffractive optics comprises optic-powered implemented optics.